Low-background Counting Facilities

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The LBNL Low Background Facilities (LBF) consist of a Berkeley site and an Oroville site specially configured for low-background gamma-ray spectroscopy. The Berkeley site was established in 1963 and consists of a 3-m by 7-m by 3-m room surrounded by 1.6-m of specially selected low-background concrete shielding. The aggregate in this concrete is from serpentine gravel, which is low in U, Th, and K. This barrier was made to shield against accelerator-produced neutrons and natural gamma radiation as well as some cosmic rays. Also, the low-activity concrete emits little radon, and a HEPA-filtered air system constantly purges the room to reduce airborne radon.

Detectors at this site include a 20 cm diameter by 10 cm thick NaI crystal, two 30% p-type Ge spectrometers (one of these with an external active cosmic ray veto), and two 80% p-type Ge spectrometers, available for fieldwork. These detectors each have small local shields consisting of 10 cm of Pb. The overall shielding reduces background to the point where cosmic rays and activity within the detector assembly are the dominant sources of background.

The LBF Oroville site is located in the powerhouse of the Oroville Dam, under 180-m of rock cover. This site now has three Ge spectrometers: a 115% n-type, an 80% p-type, and a 30% p-type. This site is used for our most sensitive counting, particularly for materials certification, since the cosmic-ray background is reduced underground by about a factor of 1000 compared to surface. Sensitivities of 50 parts-per-trillion (PPT) for U and daughters, 200 PPT for Th and daughters, and 100 parts-per-billion for K are realized at the Oroville site. Much of our total work last year required the Oroville site; a fact that justified adding an additional detector.

Over the years, the LBF has been involved in a wide variety of experiments supporting programs in basic and applied science from LBNL and a variety of other institutions. This last year, work mainly involved: 1) low-activity materials certification for CDMS II, SNO, and KamLAND, 2) neutron activation, and 3) environmental health and safety activities.

The facility is involved with three major fundamental physics projects, two of which have just been funded, and are expected to utilize much of the facility's capabilities over the next several years. 1) The second generation Cold Dark Matter search, which will provide substantial support for materials certification. 2) The KamLAND neutrino experiment, also involving material certification, and 3) the CUORE experiment in the Gran Sasso in Italy. This experiment would involve the facility in neutron activation, materials studies, and cryogenic detector technology. Scientists from the facility would also become involved in data taking and analysis of the experiment.

A moderate amount of materials characterization work was performed for the UCB Cold Dark Matter experiment (CDMS II) and materials work was begun for KamLAND.

The neutron activation program continued with work involving the fabrication of NDT Ge thermistors for the CUORE experiment in Italy.

A successful program of characterization of legacy radioactive materials concluded and a similar program for HEPA filter disposal is in progress. Substantial work on the Bevalac decommissioning and the LBNL radiological site characterization is expected.

The facility is also involved in a small soil-profile project related to paleo-indian artifacts from Michigan.

The facility continues to pursue opportunities involving direct counting and neutron activation of biological samples for programs involving bioremediation.